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We claim:

1. A microfluidic device comprising:

a substrate bearing a plurality of constrictions, each of said constrictions being separated from one another by a gap having a distance D<sub>1</sub>;

means for passing polarizable particles in the vicinity of said constrictions; and means for applying a dielectrophoric field to said substrate, wherein said particles are trapped in said gap by said dielectrophoric field.

2. The device of claim 1 wherein said means for passing particles in the vicinity of said constrictions comprises:

fluid input means for inputting a fluid comprising a concentration of said polarizable particles.

- 3. The device of claim/2 wherein said fluid input means is a syringe pump.
- 4. The device of claim 1 wherein said means for applying a dielectrophoric field comprises:

an electrical signal applied to a pair of electrodes positioned on opposite edges of to said substrate.

- 5. The device of claim 1 wherein said electrical signal is an AC voltage at a predetermined frequency.
- 6. The device of claim 5 wherein the applied frequency is between about 1 Hz and about 1 Ghz.
- 7. The device of claim 1 wherein said electrical signal is a DC voltage at a predetermined frequency.
- 8. The device of claim 1 wherein said constrictions are formed on said substrate using a photolithography etch.

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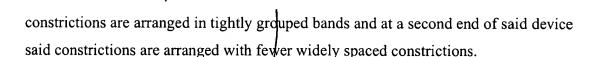
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- 9. The device of claim 1 wherein said polarizable particles are selected from the group consisting of single-stranded DNA, double-stranded DNA, RNA, biological cells and polymer particles.
- 10. The device of claim 1 wherein said distance  $D_1$  is in the range of about 0.1 mm to about 300  $\mu m$ .
- 11. The device of claim 1 wherein each of said constrictions have a height in the range of about 0.5 μm to about 5.0 μm.
  - 12. The device of claim 1 wherein said distance  $D_1$  is about 1  $\mu$ m, a height of said constrictions is about 1.25  $\mu$ m and said particles are polyonucleotides of DNA or RNA.
  - 13. The device of claim 1 wherein said constrictions are formed in a plurality of rows being separated from one another by a distance  $D_2$  wherein said distance  $D_2$  is selected to vary an electric field gradient of said electric field.
  - 14. The device of claim 1 wherein said constrictions have a trapezoidal shape with side edges angled from a bottom edge.
  - 15. The device-of claim 1 wherein said constrictions are formed of a material selected from quartz and silicon.
  - 16. The device of claim 1 further comprising a cover, said cover being coupled to said substrate with a sealing layer.
- 17. The device of claim 1 wherein said plurality of constrictions are arranged in regions wherein in a first said region at a first end of said device in a second region said

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- 18. The device of claim 17, further comprising a third region intermediate of said first regions and said second region said third region having intermediate spacing of said constrictions.
  - 19. The device of claim 17, further comprising one or more channels coupled to end of said regions for extracting said polarizable particles from each of said regions
  - 20. The device of claim 1 further comprising a matrix in a channel downstream from the plurality of constrictions capable of fractioning and/or analyzing the polarizable particles released from the plurality and constrictions.
  - 21. The device of claim 1, further comprising imaging equipment to visualize the polarizable particles.
  - 22. The device of claim 1, wherein the substrate comprises a material selected from the group consisting of SiO2, polymide, p-xylylene, PDMS or PMMA.
  - 23. The device of claim 1, further comprising heating means adjacent said constrictions.
  - 24. A method of concentrating a polarizable particle or molecule using the microfluidic device of claim 1 comprising the steps of:
    - a) providing the microfluidic device;
    - b) introducing a fluidic sample comprising polarizable particles or molecules; and
    - c) applying an electric current to the device and fluid of step b.
- 25. The method of claim 24 wherein the fluidic sample is introduced using a DC current.

a)

current (AC). 27. The method of claim 24 wherein the electric current of step c is a direct 5 current (DC). A method of concentrating particles or molecules on a silicon or glass chip 28. using the device of claim 1 comprising the steps of: providing the microfluidic device of claim 1 comprising channels; 10 a) b) dispersing a fluidic sample comprising particles or molecules through the channels; c) applying an electric current; concentrating sald particles or molecules; and d) applying said particles or molecules to the silicon or glass chip. 15 e) 29. A method of improving the hybridization rate of polynucleotide molecules using the microfluidic device  $\phi$ f claim 1 comprising the steps of: 20 a) providing the microfluidic device of claim 1 comprising constrictions having a concentrated polynucleotide sample; b) introducing a probe to said microfluidic device; applying an electric current; c) d) concentrating said probe to the constrictions of the microfluidic device; and 25 hybridizing said probe with the polynucleotide sample. e) 30. A method of improving the rate of a polymerase chain reaction (PCR) using the device of claim 1 comprising the steps of:

26. The method of claim 24 wherein the electric current of step c is an alternating

providing the device of claim 1;

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- b) introducing PCR reaction components comprising primers, template polynucleotide and nucleotides to the device; and
- c) concentrating the PCR reaction components by applying an electric current to the device.
- 31. A method of fractioning particles or molecules using the device of claim 13 comprising the steps of:
- a) providing the device of claim 13 comprising a plurality of constrictions of varying concentration;
  - b) introducing a fluidic sample;
  - c) applying an electric current to said device; and
  - d) fractioning the particles or molecules by size.
  - 32. The method of claim31 wherein the molecules are polynucleotides.